8
Chapter

Force and Pressure

We'll cover the following key points:

- Force & its Characteristics
- Types of Force
- Pressure and Pressure Exerted by Liquids & Gases
- Atmospheric Pressure

Hi, I'm EeeBee

Do you Remember:

Fundamental concept in previous class.

In class 5th we learnt

- Introduction of Force and Energy

Still curious? Talk to me by scanning the QR code.

Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the concept of force and learn about the SI unit used to measure it.
- Differentiate between contact forces and non-contact forces.
- Comprehend the concept of pressure and explore its practical applications in real-life scenarios.
- Learn about lateral pressure exerted by liquids and the concept of atmospheric pressure.

Guidelines for Teachers

To help students grasp the concepts of force and pressure effectively, teachers can:

- **Prepare Students Thoroughly:** Introduce the fundamentals of force and pressure, covering definitions, measurement units, and practical uses.
- **Incorporate Hands-On Learning:** Use real-life examples and interactive experiments to explain abstract concepts, ensuring students connect theory with practice.
- **Encourage Critical Thinking:** Facilitate discussions that prompt students to analyze the significance of force and pressure in different real-world scenarios.

NCF Curricular Goals and Competencies

This chapter aligns with the following curricular objectives:

- CG-1 (C 1.1): Investigates the nature and properties of matter, including its constituents and behaviors.
- CG-6 (C 6.1): Explores the processes of scientific inquiry and the evolution of scientific knowledge through experimentation and observation.

FORCE AND PRESSURE

Mind Map

Force & its Interaction

A push or a pull on an object is called a force.

Forces are due to an Interaction

Chracterstics of force

- ✓ Forces applied on an object in the same direction add to one another.
- ✓ If the two forces act in the opposite directions on an object, the net force acting on it is the difference between the two forces.
- ✓ The strength of a force is usually expressed by its magnitude.
- ✓ A Force can Change the State of Motion.
- ✓ Force can Change the Shape of an Object.

Contact Forces

The force can be applied only when it is in contact with an object.

Types

- Muscular Force
- Friction:- The force of friction always acts on all the moving objects and its direction is always opposite to the direction of motion.

Non-contact Forces

A force without being in contact with the object..

Types

Magnetic Force

Electrostatic Force

Gravitational Force

Pressure

The force acting on a unit area of a surface is called pressure.

Pressure = $\frac{\text{Force}}{\text{Area}}$ on which it acts.

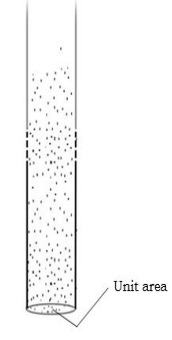
Pressure Exerted by Liquids and Gases

- Liquids exert pressure on the walls of the container
- Liquids exert equal pressure at the same depth.

- Gases, too, exert pressure on the walls of their container.

Atmospheric Pressure

The pressure exerted by air is known as atmospheric pressure.



Based on NCERT*

Force & its Characteristics

Aarav is reading his science book when his elder brother, Rohan, walks in.

Force

An object either remains in rest or in motion. How does an object in rest comes in motion and an object in motion comes to rest? It is force which is responsible for these actions. In order to understand force, let us think of the following facts:

- What do you do to make a football move?
- What do you do to make a moving ball move faster?
- Why does a ball rolling on the ground slow down and finally come to rest?
- How does a goalkeeper stop a ball?

In History...

The concept of force and pressure has been explored for centuries, with early foundations laid by ancient Greek philosophers like Archimedes. In the 3rd century BCE, Archimedes discovered the principle of buoyancy, stating that an object submerged in a fluid experiences an upward force equal to the weight of the displaced fluid. This was an early understanding of how force and pressure work in fluids.

Later, in the 17th century, scientists like Blaise Pascal contributed significantly to the study of pressure. Pascal's Law (1647) demonstrated that pressure applied to an enclosed fluid is transmitted equally in all directions, laying the groundwork for modern fluid mechanics.

The study of force and pressure became more advanced with Sir Isaac Newton's laws of motion in the 17th century, providing a comprehensive framework for understanding how forces influence motion, leading to significant developments in physics.

- How do fielders stop a ball hit by a batsman?
- How does a hockey player change the direction of the moving ball with a flick of the stick?

In all these situations the ball, i.e., an object either comes in motion from rest or becomes in rest from motion. The ball is either made to move faster or slower or its direction of motion is changed. Force is the factor which is responsible for all these actions. Force has been applied on a ball when it is kicked, pushed, thrown or flicked. Let us explore more.

(a) A goalkeeper saving a goal,

Force : A Push or a Pull

In our day to day life, we come across several actions in which force is involved. For example:

- When we lift a bucket of water from a well by pulling the rope tied to the bucket, we are applying force to lift the bucket.

(b) A fielder stopping a ball, and (c) A hockey player flicking a ball

- When we are shutting or opening a door, we are applying force on the door.
- When we are pushing or pulling a drawer, we are applying force on the drawer.
- When we are fixing a nail into a wall by hitting the nail with a hammer, we are applying force to the nail.
- When a batsman hits a cricket ball, he is applying force.
- When a football player kicks the ball, he is applying force on the ball.
- When we squeeze a lemon piece to bring out juice, we are applying force on the lemon piece.
- In a horse cart, the horse pulls the cart by applying force.

If we carefully examine all these actions, we find that we are either pushing or pulling the objects. So, we can say that in every action of pushing or pulling an object, force is involved. In science, a push or a pull on an object is called a force. Thus, we can say that the motion imparted to objects was due to the action of a force.

Activity

Identifying different actions as push or pull gives some examples of familiar situations involving motion of objects. You can add more such situations or replace those given here. Try to identify action involved in each case as a push and/or a pull and record your observations. One example has been given to help you.

Do you notice that each of the actions can be grouped as a pull or a push or both? Can we infer from this, that to move an object, it has to be pushed or pulled? In science, a push or a pull on an object is called a force. Thus, we can say that the motion imparted to objects was due to the action of a force. When does a force come into play? Let us find out.

We learnt in Class VI that a magnet attracts a piece of iron towards it. Is attraction also a pull? What about repulsion between similar poles of two magnets? Is it a pull or a push?

Unit of force

The SI unit of force is Newton (N). In CGS system, the unit of force is dyne ($1N = 10^5$ dynes).

Effects of force

A force may make the following effects when it acts on an object:

A force may change the state of rest or of motion of an object

When a football player kicks a stationary ball, the ball comes to move, i.e., if the state of rest changes to state of motion by the action of force. When a moving football is stopped by a goalkeeper, its state of motion changes to state of rest.

A force can change the speed of a moving object

If a football player applies a force on an already moving ball in the direction of the movement, the speed of the ball increases. Thus, a force can change the speed of a moving object.

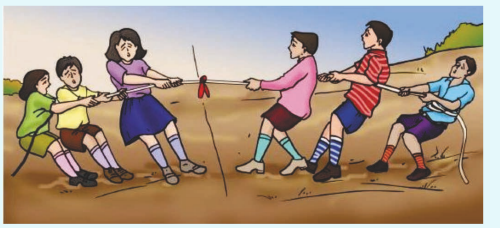
Let us see how a force changes the state of an object, i.e., how an object in rest comes into motion, how the speed changes and how an object in motion comes to rest by the application of force by performing the following activities.

Activity

Choose a heavy object like a table or a box, which you can move only by pushing hard. Try to push it all by yourself. Can you move it? Now ask one of your friends to help you in pushing it in the same direction. Is it easier to move it now? Can you explain why?

Two friends pushing a heavy load (a) in the same direction, (b) in opposite directions

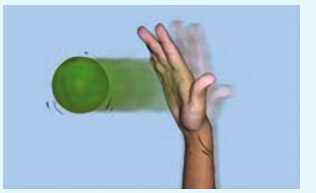
Next push the same object, but ask your friend to push it from the opposite side. Does the object move? If it does, note the direction in which it moves. Can you guess which one of you is applying a larger force?



The rope may not move if the two teams pull at it with equal force

Activity

Take a rubber ball and place it on a level surface such as a table top or a concrete floor. Now, gently push the ball along the level surface. The ball will move. Push the ball again while it is still moving. You will see that the speed of the ball will increase.



A ball at rest begins to move when a force is applied on it

Next, place your palm in front of the moving ball. Remove your palm as soon as the moving ball touches it. Does your palm apply a force on the ball? The speed of the ball will decrease. If you hold the ball it will stop, i.e., it will come in rest position.

Conclusion : Application of force changes the state of an object from rest to motion and motion to rest. Force also changes the speed of an object.

I have seen children competing with one another in moving a rubber tyre or a ring by pushing it. I now understand why the speed of the tyre increases whenever it is pushed.

A force can change the direction of motion of a moving object

In cricket, the direction of motion of the ball changes when the batsman strikes the ball.

A force can change the shape or size of an object

On pressing, the shape of a sponge changes. When an inflated balloon is pressed between the palms, its shape changes. The shape and size of a ball of dough changes when it is rolled to make chapatti. Thus, force can change the shape and size of objects.

State of Motion

The state of motion of an object is described by its speed and the direction of motion. The state of rest is considered to be the state of zero speed. An object may be at rest or in motion; both are its states of motion.

Thus we see that while a force may cause one or more of these effects, it is important to remember that none of these actions can take place without the action of a force. Thus, an object cannot move by itself, it cannot change speed by itself, it cannot change direction by itself and its shape cannot change by itself.

KEYWORDS

Sponge Changes: Reversible physical changes in shape or size.

Dough Changes: Irreversible chemical changes during fermentation or cooking.

Let's recall what we know

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

Apply Concept in Real-Life Context

Apply

1. Why do you think it is harder to lift an object than to push it across a flat surface?
2. When you throw a ball into the air, it eventually comes back down. Why does this happen?

Skills Covered: Critical and logical thinking, brainstorming, applicative thinking

Examine Further

Analyse

1. Explain how balanced and unbalanced forces affect the motion of an object. Give examples of each.
2. Why is it that heavier objects require more force to move compared to lighter ones?

Skills Covered: Critical analysis, logical reasoning, brainstorming

Self-Assessment Questions

Evaluate

1. What is force? List two real-life examples of force in action.
2. How does the direction of applied force influence the movement of an object?
3. What are the characteristics of gravitational force, and how does it affect objects on Earth?
4. Identify and explain two contact forces and two non-contact forces.

Skills Covered: Reflective thinking, critical thinking, knowledge recall

Creative Insight

Create

Conduct an experiment to demonstrate the effect of direction on force:

1. Take a small ball and roll it on a flat surface.
2. Use your hand to stop the ball and change its direction by applying force.
3. Observe and note how the ball's motion changes when force is applied from different directions.

Write your observations and conclusions in your notebook, explaining how direction impacts force application.

Skills Covered: Creativity, observation, critical and logical thinking, brainstorming, applicative thinking

Types of Force

One afternoon, Rohan is playing with a toy car when his father, Arun, walks in.

Force may be divided as contact force and non-contact force.

Contact force

In all the examples discussed so far in this chapter, the interacting objects have to be in contact with each other for the force to come into play. Such forces are called contact forces. So, we can say that contact forces are the type of forces that result when the interacting bodies are in physical contact with each other. Muscular force and friction are examples of contact forces.

Activity

Take a ball and place it on a level surface as you did in activity 3 and move the ball by giving a push. Now place the ruler from your geometry box in its path as shown in. In doing so, you would apply a force on the moving ball. Does the ball continue to move in the same direction after it strikes the ruler? Repeat the activity and try to obstruct the moving ball by placing the ruler such that it makes different angles to its path. In each case note your observations about the direction of motion of the ball after it strikes the ruler.

(a) A ball set in motion by pushing it along a level surface and (b) the direction of motion of the ball after it strikes the ruler placed in its path

Let us learn about some of these forces.

Muscular force

The force resulting due to the action of human or animal body is called muscular force. When we push an object like a school bag or lift a bucket of water, the force, in fact, comes from the action of our muscles and hence such forces are called muscular forces. Animals also make use of muscular force to carry out their physical activities and other tasks. Animals like bullocks, horses, donkeys and camels are used to perform various tasks for us. In performing these tasks they use muscular force.

Muscular force of animals is used to carry out many difficult tasks

Since muscular force can be applied only when it is in contact with an object, it come under the contact force.

It is the muscular force that enables us to perform all activities involving movement or bending of our body.

Friction or frictional force

In order to understand the friction or frictional force, let us consider the following situations of our day to day experience:

- A ball rolling along the ground gradually slows down and finally comes to rest.
- When we stop pedalling a bicycle, it gradually slows down and finally comes to a stop.
- A car or a scooter also comes to rest once its engine is switched off. Similarly, a boat comes to rest if we stop rowing it.
- When we switch off an electric fan, its speed gets slowed down and finally comes to rest.
- When we stop pedalling a sewing machine, the speed of its needle gets slowed down and finally comes to rest.

In all these cases, in fact, we are not applying any force from outside to cease the motion of the objects, yet their speed gradually decreases and finally they come to rest after some time. As the speed of the objects gets slowed down and finally come to rest, it is obvious that there should be some force acting on the objects so that their speed decreases and the objects finally comes to rest. The force responsible for changing the state of motion of objects in all these examples is the force of friction. Whenever one surface moves or tries to move over another surface, the force of friction starts acting on the surfaces. It always opposes the motion of the

objects. Thus,

- It is the force of friction between the surface of the ball and the ground that brings the moving ball to rest.
- It is the force of friction between the surface of the cycle tyre and the ground that brings the moving cycle to rest.
- The force of friction always acts on all the moving objects and its direction is always opposite to the direction of motion.

Non-contact forces

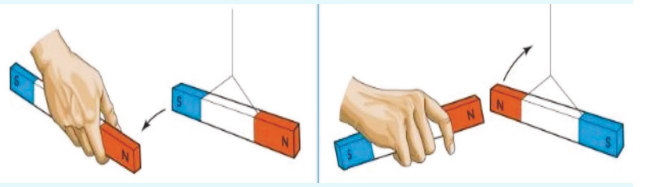
The forces which come into play without coming of the objects in contact with each other are called non-contact forces. These are :

Magnetic force | **Electrostatic force** | **Gravitational force**

Magnetic force

We know that unlike poles of magnets attract (push) each other, while like poles of magnets repel (pull) each other. The magnet also attracts the magnetic substances. For example, a magnet attracts iron nails. The attraction of magnetic objects by a magnet and the attraction between unlike poles of magnets and the repulsion of like poles of magnets are the examples of magnetic forces. These forces come into play without coming in contact with each other or without the contact of the magnet and the magnetic substances like iron nails. Thus magnetic force is an example of non-contact force.

Activity



Aim : To demonstrate magnetic force

Things required : Two bar magnets

Method : Take the magnets. Place one magnet on the table. Hold the other magnet in your hand and bring it closer to the first magnet. Record your observation.

Observation : You will notice that when the magnet held in the hand is moved, the other magnet moves either towards it or away from it.

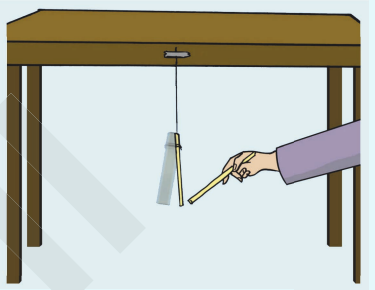
Explanation : The magnets move away when like poles face each other. On the other hand, the magnets get attracted when unlike poles face each other.

Electrostatic Force

The force exerted by a charged body on another charged or uncharged body is known as electrostatic force. This force comes into play even when the bodies are not in contact. The electrostatic force, therefore, is another example of a non-contact force.

Activity

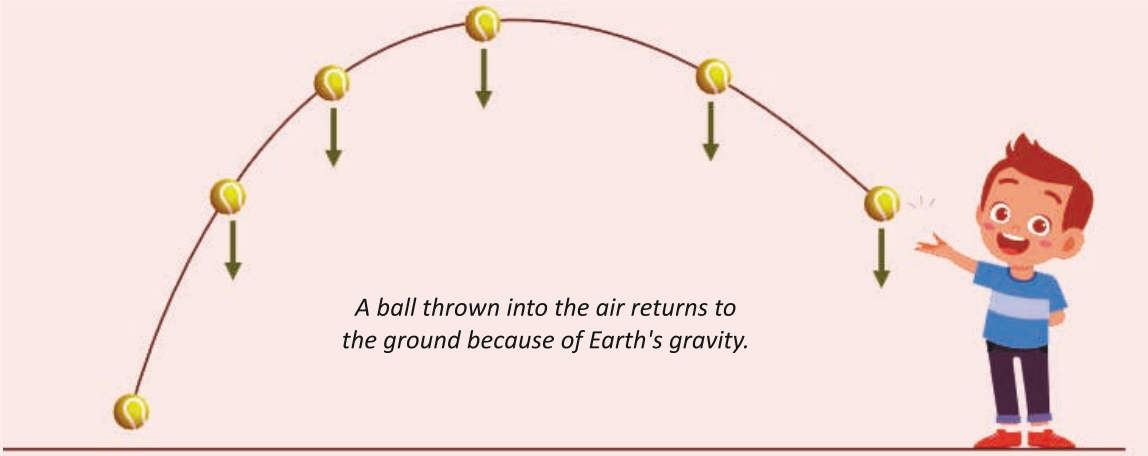
Take a plastic straw and cut it into nearly two equal pieces. Suspend one of the pieces from the edge of a table with the help of a piece of thread. Now hold the other piece of straw in your hand and rub its free end with a sheet of paper. Bring the rubbed end of the straw near the suspended straw. Make sure that the two pieces do not touch each other. You will see that the rubbed piece attract the other piece. Next, rub the free end of the suspended piece of straw with a sheet of paper. Again, bring the piece of straw that was rubbed earlier with paper near the free end of the suspended straw. You will observe that they attract each other.



A straw rubbed with paper attracts another straw, but repels it if it has also been rubbed with a sheet of paper

Gravitational Force

A coin or a pen falls to the ground when it slips off your hand. The leaves or fruits also fall to the ground when they get detached from the plant. We know that the earth attracts everything towards itself. This property of the earth is known as gravity. The force with which the earth pulls everything towards itself is called gravity. Gravity is not a property of the earth alone. In fact, every object in the universe, whether small or large, exerts a force on every other object. This force is known as the gravitational force.



A ball thrown into the air returns to the ground because of Earth's gravity.

Let's recall what we know

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Take a Task

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Bloom's Taxonomy

Apply Concept in Real-Life Context

Apply

1. Why do you think magnetic objects are attracted to a magnet without physical contact?
2. When you stretch a rubber band and let it go, it snaps back to its original shape. Why does this happen?

Skills Covered: Critical and logical thinking, brainstorming, applicative thinking

Examine Further

Analyse

1. Explain the difference between contact and non-contact forces, and give two examples of each.
2. How does gravitational force differ from magnetic force, and where do we observe these forces in daily life?

Skills Covered: Critical and logical thinking, brainstorming, applicative thinking

Self-Assessment Questions

Evaluate

1. What are contact forces? List two examples and explain how they work.
2. What are non-contact forces? Provide two examples and describe their characteristics.
3. How is tension force different from compression force? Provide examples of each.
4. Define electrostatic force and explain its applications in daily life.

Skills Covered: Reflective thinking, critical thinking, knowledge recall

Creative Insight

Create

Conduct an experiment to understand magnetic force:

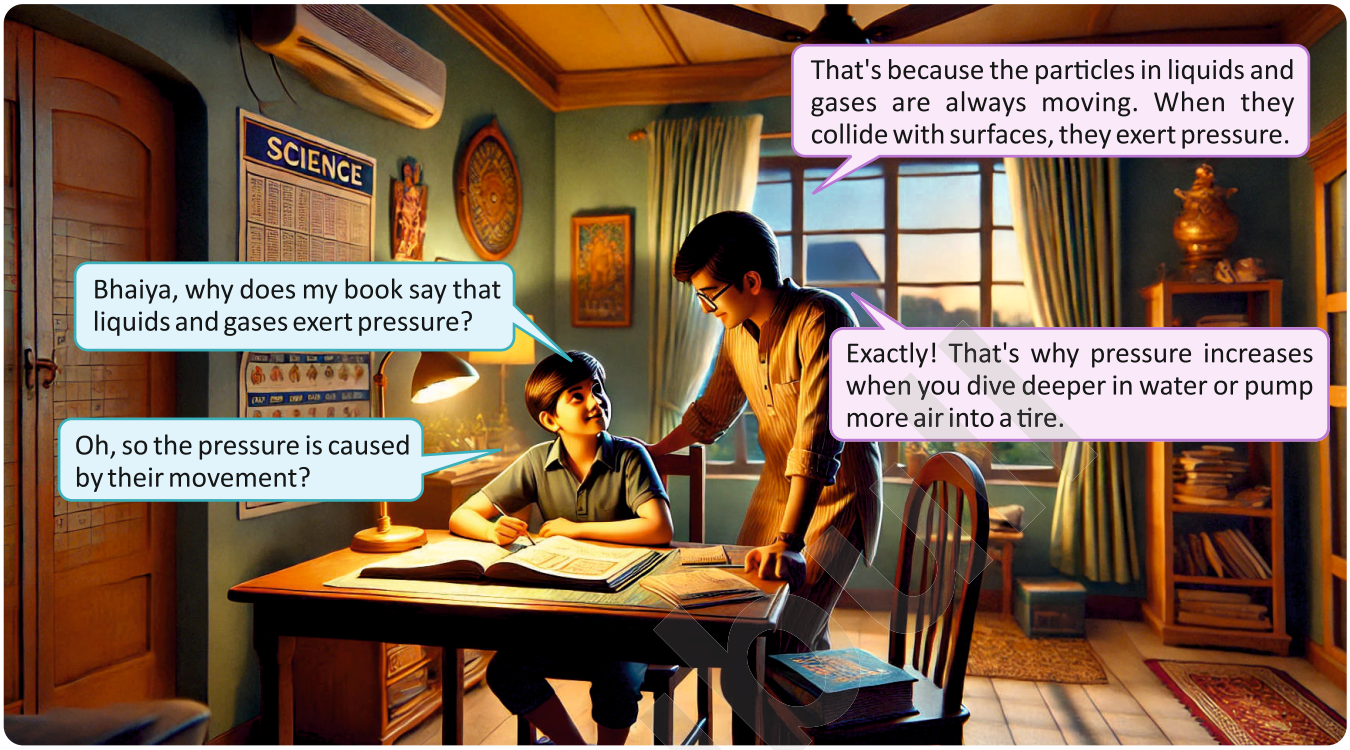
1. Take a magnet and place some small iron nails nearby.
2. Observe how the magnet attracts the nails without touching them.
3. Now move the magnet further away and observe the range of attraction.

Write your observations and conclusions in your notebook, explaining how magnetic force works as a non-contact force.

Skills Covered: Creativity, observation, critical and logical thinking, brainstorming, applicative thinking

Pressure and Pressure Exerted by Liquids & Gases

Aarav is doing his science homework when his elder brother, Kunal, walks in to help him.



Pressure

The force acting on a unit area of a surface is called pressure.

Pressure = Force / Area on which it acts

Thus, pressure depends upon the force and the area upon which it acts. As the force is in the numerator and area is in the denominator, greater the force and smaller the area, greater will be the pressure. Let us try to understand the pressure by performing the following activity :

Activity

Try to push a nail into a wooden plank by its head. You could not succeed but when you try to push the nail by the pointed end you get success. From this activity, it is clear that greater the area, smaller is the pressure and smaller the area, greater is the pressure.

Pushing a nail into a wooden plank

Pressure-area relationship can be seen in the following situations also:

- Broader straps are provided in the shoulder bags so that it can exert less pressure on the shoulder.

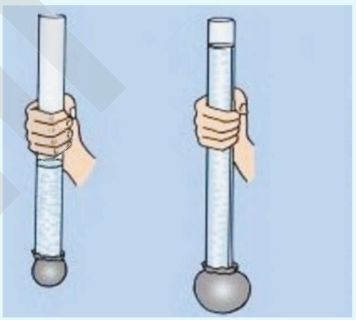
- Iron nails, drawing pins, alpins, etc. have sharper ends so that they can penetrate easily.
- The edge of all cutting tools like blade, knife, kachia, khurpi, etc. are made sharper so that due to lesser area greater pressure can be exerted to work properly.
- Camels can walk easily on sand because of their broader feet area.
- The rear wheels of tractors are made broader so that they exert less pressure on the soil and hence easily go through.

Pressure exerted by liquids and gases

Liquids and gases also exert pressure. Liquids and gases exert pressure on the walls of the containers. Let us see these in the following activities:

Activity

Take a transparent glass tube or a plastic pipe. The length of the pipe/tube should be about 15 cm and its diameter should be 5-7.5 cm. Also take a piece of thin sheet of a good quality rubber, say, a rubber balloon. Stretch the rubber sheet tightly over one end of the pipe. Hold the pipe at the middle, keeping it in a vertical position. Ask one of your friends to pour some water in the pipe. Does the rubber sheet bulge out? Note also the height of the water column in the pipe. Pour some more water. Observe again the bulge in the rubber sheet and the height of the water column in the pipe. Repeat this process a few more times. Can you see any relation between the amount of the bulge in the rubber sheet and the height of the water column in the pipe?



Pressure exerted by water at the bottom of the container depends on the height of its column

Activity

Take a plastic bottle. You can take a discarded water or soft drink bottle. Fix a cylindrical glass tube, a few cm long near its bottom as shown in. You can do so by slightly heating one end of the glass tube and then quickly inserting it near the bottom of the bottle. Make sure that the water does not leak from the joint. If there is any leakage, seal it with molten wax. Cover the mouth of the glass tube with a thin rubber sheet. Now fill the bottle up to half with water. What do you observe? Why does the rubber sheet fixed to the glass tube bulge this time? Pour some more water in the bottle. Is there any change in the bulge of the rubber sheet?

A liquid exerts pressure on the walls of the container.

Note that the rubber sheet has been fixed on the side of the container and not at the bottom. Does the bulging of the rubber sheet in this case indicate that water exerts pressure on the sides of the container as well? Let us investigate further.

Activity

Take an empty plastic bottle or a cylindrical container. You can take a used tin of talcum powder or a plastic bottle. Drill four holes all around near the bottom of the bottle. Make sure that the holes are at the same height from the bottom. Now fill the bottle with water. What do you observe?

Does the water coming out of the holes falls at the same distance from the bottle? What does this indicate?

Liquids exert equal pressure at the same depth

and you now say that liquids exert pressure on the walls of the container?

Do gases also exert pressure? Do they also exert pressure on the walls of their containers? Let us find out.

I have seen fountains of water coming out of the leaking joints or holes in pipes supplying water. Is it not due to the pressure exerted by water on the walls of the pipes?

When you inflate a balloon, why do you have to close its mouth? What happens when you open the mouth of an inflated balloon? Suppose you have a balloon which has holes. Would you be able to inflate it? If not, why? Can we say that air exerts pressure in all directions?

Let's recall what we know

Apply Concept in Real-Life Context

Apply

1. Why do sharp knives cut better than blunt ones?
2. Why does a person feel lighter when swimming underwater compared to standing on land?

Skills Covered: Critical and logical thinking, brainstorming, applicative thinking

Examine Further

Analyse

1. Explain how pressure changes with depth in a liquid. Provide an example to illustrate this concept.
2. Why do inflated balloons burst when squeezed or overfilled?

Skills Covered: Critical and logical thinking, brainstorming, applicative thinking

Self-Assessment Questions

Evaluate

1. What is pressure? Write its formula and give an example.
2. How does pressure depend on force and the area over which it is applied?

SCAN TO ACCESS

Take a Task

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Bloom's Taxonomy

3. Why do deep-sea divers use special suits when they dive to great depths?
4. How do liquids and gases exert pressure on the walls of their containers?

Skills Covered: Reflective thinking, critical thinking, knowledge recall

Creative Insight

Create

Design a simple experiment to demonstrate that liquids exert pressure on the walls of their container:

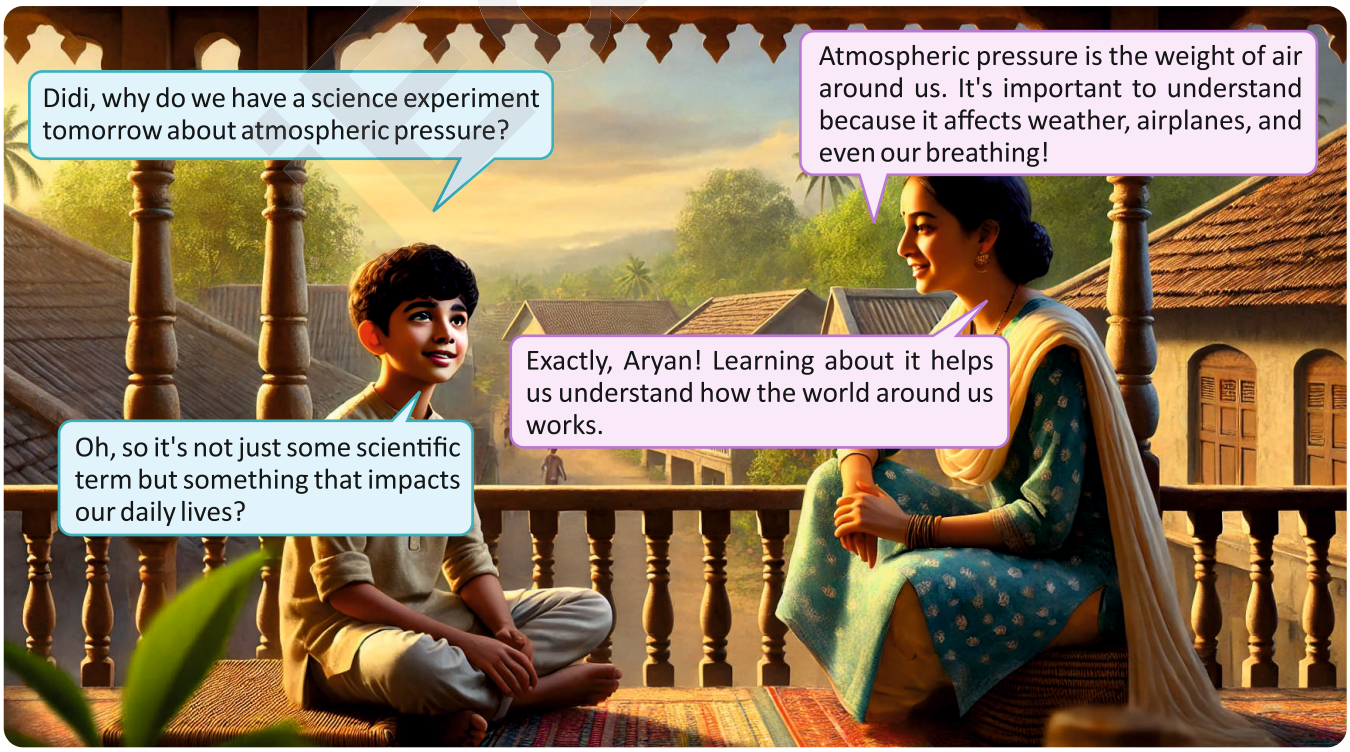
1. Take a plastic bottle and make small holes at different heights on its side.
2. Fill the bottle with water and observe how the water flows out from the holes.
3. Record your observations and explain how pressure varies with depth in a liquid.

Write your conclusions in your notebook, explaining the relationship between liquid pressure and depth.

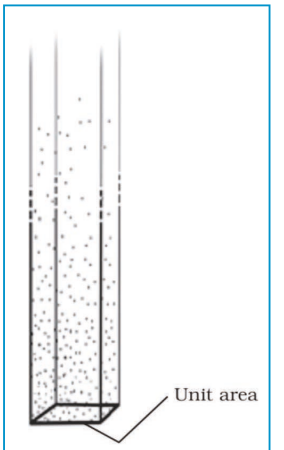
Skills Covered: Creativity, observation, critical and logical thinking, brainstorming, applicative thinking

Atmospheric Pressure

Aryan is sitting on the balcony when his cousin, Meera, joins him.



You know that there is air all around us. This envelop of air is known as the atmosphere. The atmospheric air extends up to many kilometres above the surface of the earth. The pressure exerted by this air is known as atmospheric pressure. We know that pressure is force per unit area. If we imagine a unit area and a very long cylinder standing on it filled with air, then the weight of the air in this cylinder is the atmospheric pressure.



Atmospheric pressure is the weight of air in a column of unit area

But, how large or small is the atmospheric pressure? Let us get an idea about its magnitude.

When you press the sucker, most of the air between its cup and the surface escapes out. The sucker sticks to the surface because the pressure of atmosphere acts on it. To pull the sucker off the surface, the applied force should be large enough to overcome the atmospheric pressure. This activity might give you an idea about the magnitude of atmospheric pressure. In fact, it would not be possible for any human being to pull the sucker off the surface if there were no air at all between the sucker and the surface. Does it give you an idea how large the atmospheric pressure is?

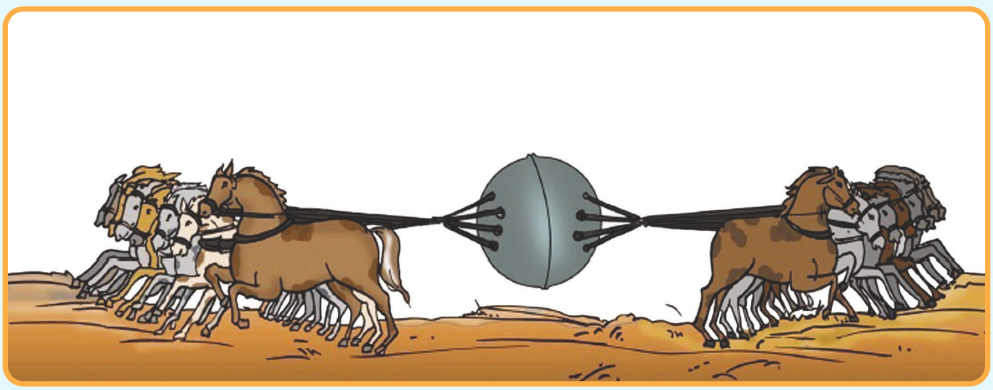

Pressure of atmosphere on your head

If the area of my head were 10 cm × 10 cm, how much weight of air would I be carrying on my head?

The weight of air in a column of the height of the atmosphere and area 10 cm × 10 cm (Fig.) is as large as 1000 kg. The reason we are not crushed under this weight is that the pressure inside our bodies is also equal to the atmospheric pressure and cancels the pressure from outside.

Did you know

Otto von Guericke, a German scientist of 17th century, invented a pump to extract air out of the vessel. With the help of this pump, he demonstrated dramatically the force of the air pressure. He joined two metallic hemispheres of 51 cm diameter each and pumped air out of them. Then he employed eight horses on each hemisphere to pull them apart. So great is the force of air pressure that the hemispheres could not be pulled apart.


Horses pulling the hemispheres

Let's recall what we know

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

Apply Concept in Real-Life Context

Apply

1. Why does a juice box get crushed when you suck the air out of it using a straw?
2. Why do we feel a popping sensation in our ears when travelling to high altitudes or during flights?

Skills Covered: Critical and logical thinking, brainstorming, applicative thinking

Examine Further

Analyse

1. Explain how atmospheric pressure changes with altitude and how it affects living organisms.
2. Why do weather balloons expand as they rise higher into the atmosphere?

Skills Covered: Critical and logical thinking, brainstorming, applicative thinking

Self-Assessment Questions

Evaluate

1. What is atmospheric pressure, and how is it measured?
2. How does atmospheric pressure influence the boiling point of water?
3. What causes variations in atmospheric pressure at different places on Earth?
4. List two real-life examples of the effects of atmospheric pressure.

Skills Covered: Reflective thinking, critical thinking, knowledge recall

Creative Insight

Create

Design a simple experiment to demonstrate the effect of atmospheric pressure:

1. Take an empty glass bottle and heat its neck using warm water.
2. Quickly place a balloon over the bottle's opening as it cools down.
3. Observe how the balloon gets sucked into the bottle as the air inside contracts due to cooling.

Write your observations and explain how atmospheric pressure is responsible for this phenomenon.

Skills Covered: Creativity, observation, critical and logical thinking, brainstorming, applicative thinking

SUMMARY

1. Force and Its Characteristics

Definition of Force:

A push or pull acting on an object that can cause it to move, stop, change direction, or alter its shape.

Characteristics of Force:

- Has both magnitude (strength) and direction, making it a vector quantity.
- Can act through contact (e.g., pushing a door) or from a distance (e.g., gravitational pull).
- Can cause a stationary object to move or a moving object to stop.
- May deform objects, temporarily or permanently, depending on the material.

2. Types of Forces

Contact Forces: Require physical contact to act.

- **Muscular Force:** Applied by muscles, such as lifting or pushing.
- **Frictional Force:** Opposes motion between two surfaces in contact.
- **Tension Force:** Acts through ropes or strings under pull.

Non-Contact Forces: Act without physical contact.

- **Gravitational Force:** Pulls objects toward Earth or between any two masses.
- **Magnetic Force:** Acts between magnets or magnetic materials.
- **Electrostatic Force:** Attraction or repulsion between charged particles.

3. Pressure and Its Effects

Definition of Pressure:

The force exerted per unit area on a surface.

Pressure in Liquids:

- Liquids exert pressure in all directions.
- The pressure increases with depth due to the weight of the liquid above.

Pressure in Gases:

- Gases exert pressure on the walls of their container due to the motion and collision of particles.
- Can vary with temperature and volume changes.

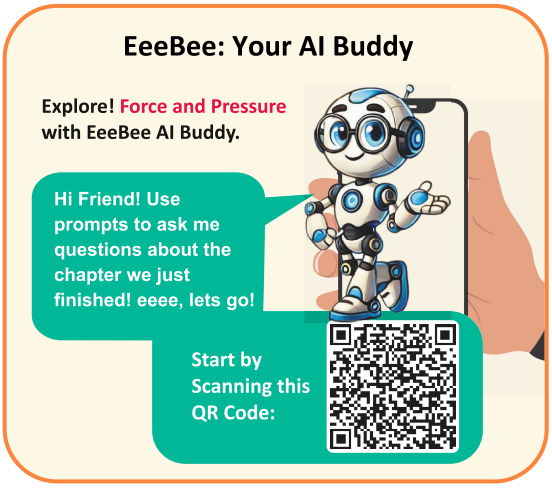
4. Atmospheric Pressure

Definition:

The pressure exerted by the Earth's atmosphere due to the weight of air above a surface.

Characteristics:

- Decreases with altitude as the air becomes less dense.
- Responsible for phenomena like the functioning of a straw or a barometer.
- Affects weather patterns, with variations linked to high and low-pressure systems.



Gap Analyzer™
Take a Test

EXERCISE

That turn curiosity into confidence—let's begin!

A. Choose the correct answer.

1. Which of the following is a contact force?
   (a) Gravitational force ☐ (b) Magnetic force ☐
   (c) Friction ☐ (d) Electric force ☐
2. What is the SI unit of force?
   (a) Joule ☐ (b) Newton ☐
   (c) Pascal ☐ (d) Watt ☐
3. Which of the following affects pressure in liquids?
   (a) Volume ☐ (b) Depth ☐
   (c) Color ☐ (d) Temperature ☐
4. Atmospheric pressure is measured using:
   (a) Thermometer ☐ (b) Barometer ☐
   (c) Hygrometer ☐ (d) Altimeter ☐
5. Which type of force always pulls objects toward the center of the Earth?
   (a) Magnetic force ☐ (b) Gravitational force ☐
   (c) Friction ☐ (d) Centripetal force ☐

B. Fill in the blanks.

1. _____ is a push or pull acting on an object.
2. _____ forces act without direct physical contact.
3. Pressure is defined as force acting on a unit _____.
4. Atmospheric pressure decreases as we move _____ from the Earth's surface.
5. The _____ force opposes the motion of objects in contact.

C. Write True or False.

1. Gravitational force acts only on objects in contact. _____
2. Pressure in a liquid increases with depth. _____
3. Friction is an example of a non-contact force. _____
4. Atmospheric pressure can crush objects under its influence. _____

D. Define the following terms.

1. Force
2. Friction
3. Pressure
4. Atmospheric Pressure
5. Contact Force

E. Match the columns.

Column A	Column B
1. Gravitational Force	(a) Barometer
2. Friction	(b) Opposes motion
3. Magnetic Force	(c) Push or pull on objects
4. Atmospheric Pressure	(d) Non-contact force
5. Force	(e) Earth's pull

F. Give reasons for the following statements.

1. Force is required to change the motion of an object.
2. Friction causes wear and tear of surfaces.
3. Liquids exert pressure on the walls of a container.
4. Atmospheric pressure allows us to drink from a straw.
5. Pressure depends on the area over which force acts.

G. Answer in brief.

1. Explain how force can change the shape of an object.
2. What are the differences between contact and non-contact forces?
3. How does the pressure change as we go deeper into a liquid?
4. Why do objects feel lighter underwater?
5. What role does atmospheric pressure play in daily life?

H. Answer in detail.

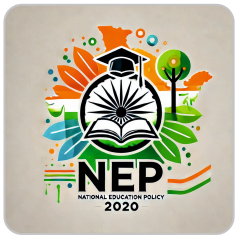
1. Describe the characteristics of force with suitable examples.
2. Explain the different types of forces with examples from daily life.
3. Discuss the concept of pressure and explain its effects with examples.
4. How is atmospheric pressure measured, and what are its practical implications?
5. How does pressure change with depth in liquids, and what are its real-world applications?

NEP Corner

Know about NEP 2020

Flexible Learning Paths:

The policy emphasizes the importance of adaptive and flexible learning tools that cater to individual learning speeds and preferences.



Skill-based Activity

Activity Time

STEM

Understanding the Effects of Force

1. Create a chart showing examples of different types of forces (contact force, non-contact force, frictional force, gravitational force).
2. Conduct a simple experiment: Push or pull objects of different weights (e.g., a book, a toy, a box) and observe the effect of the force applied.
3. Write a brief explanation of how the force changes the motion, shape, or direction of an object.
4. Reflect on how friction helps or hinders daily activities, and suggest ways to reduce unwanted friction.

Skills Covered: Creativity, Observation, Critical Thinking, Data Analysis, Responsibility, Research

Exploring Pressure in Daily Life

Analyse

1. Define pressure and explain its relationship with force and area using a real-world example (e.g., wearing heels versus flat shoes).
2. Research the role of pressure in practical applications like hydraulic systems or air travel.
3. Compare situations where high pressure is beneficial and where low pressure is necessary.
4. Suggest safety measures for dealing with high-pressure systems, such as gas cylinders or tires.

Skills Covered: Creativity, Imagination, Problem-solving, Environmental Awareness

Force and Pressure in Nature

Group Activity

1. Research how forces such as wind, water, and gravity shape natural phenomena like erosion or landslides.
2. Create a model or presentation demonstrating the effect of pressure in natural events like earthquakes or underwater geysers.

3. Discuss the role of atmospheric pressure in weather systems and predict how changes in pressure affect weather patterns.
4. Share your group's findings through a creative medium, such as a model, video, or skit.

Skills Covered: Critical thinking, Planning, Collaboration, Communication, Creativity, Teamwork, Problem-solving, Responsibility

Force and Pressure in Problem Solving

Case to Investigate

1. Describe a scenario where excessive pressure caused a failure (e.g., bursting of a pipe or a tire) and explain why it happened.
2. Create a case study of how engineers use force and pressure principles to design safer buildings, bridges, or vehicles.
3. Propose practical ways to control pressure in daily life and industrial settings.
4. Design a campaign to educate people about the safe use of force and pressure in household and industrial contexts.

Skills Covered: Observation, Critical thinking, Research, Analytical skills, Communication

Force and Pressure in Everyday Life

Aligning with SDGs

Exploring Real-Life Examples

1. Write about how pressure is used in everyday tasks, such as cutting vegetables with a knife or pumping air into a tire.
2. Identify situations where balanced and unbalanced forces are at play (e.g., a tug of war game or a moving car).
3. Create a visual representation or mind map of the effects of force and pressure in household activities.

Aligned with SDGs:

SDG 9: Industry, Innovation, and Infrastructure, SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production, SDG 13: Climate Action

Skills Covered: Research, Brainstorming, Problem-solving, Presentation skills

Applications of Force and Pressure in Technology

Integrated Learning

1. Research the working of hydraulic systems in machines like brakes, cranes, or elevators.
2. Identify and explain the principle of pressure applied in medical devices like syringes or blood pressure monitors.
3. Design a simple model using household items to demonstrate the effect of force and pressure (e.g., a balloon-powered car).

Integrated Learning: Environmental Science

Skills Covered: Brainstorming, Research, Investigation, Critical Thinking